

Lesson 4.5: Finding the Vertex

— opens down  
 U — opens up

Direction of the opening

Standard form

The **Standard Form** of a Quadratic Relation

$$y = ax^2 + bx + c$$

Practice: Fill in the table for each parabola equation

Equation	$y = 3x^2 + 2x + 1$	$y = -x^2 + 2x + 6$
y - intercept	+1	6
Direction of Opening	up	Down

This number is the y - intercept! In this case, the y - intercept would be (0, c)

— opens down  
 + opens up

Direction of the opening

factored form

The **Factored Form** of a Quadratic Relation

$$y = a(x + r)(x + s)$$

Practice: Fill in the table for each parabola equation.

Equation	$y = 3(x - 3)(x + 5)$	$y = -(x + 2)(x + 6)$
Zeros		-2 and -6
Direction of Opening	up	down
Axis of Symmetry		$-\frac{2 + (-6)}{2} = -4$

The opposites of these numbers are the zeroes of the parabola. In this case, the parabola would have zeroes of r and s. the zeros would be (r,0) & (s,0)

How can you find the Vertex???

$3x^2 + 2x + 1 = -48$   
 $3x^2 + 2x + 49 = 0$

Sub  $x = -1$  into equation

Vertex  $3(x - 3)(x + 5)$   
 $= 3(-1 - 3)(-1 + 5)$   
 $= 3(-4)(4)$   
 $= -48$

Vertex  $(-4, 4)$

add the zeros and divide by 2

Sub  $x = -4$  into the equation  
 $= -(-4 + 2)(-4 + 6)$   
 $= -(-2)(2)$   
 $= 4$

For the following quadratic relation, complete the table of values, factor the quadratic and then draw the graph.

x	$y = x^2 - x - 6$
-2	0
-1	-6
0	-6
1	-6
2	-4
3	0

1) Factor  $y = x^2 - x - 6$

$$= (x + 2)(x - 3)$$

$-2$  or  $3$

2) What is the y-intercept?

$(0, -6)$

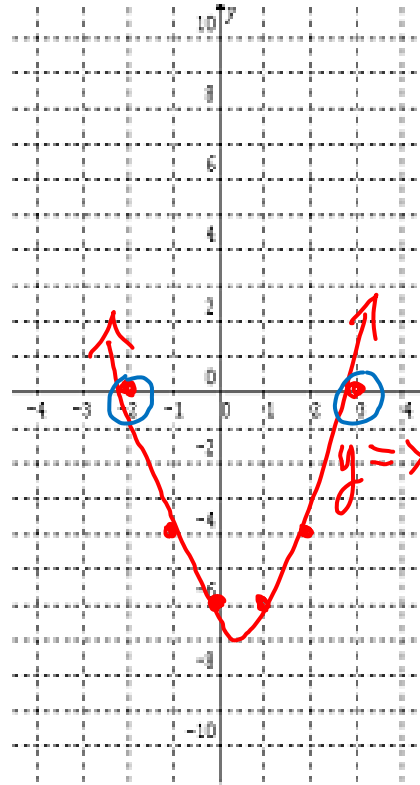
3) Determine the x-intercepts from the equation in factored form?

$(-2, 0)$  and  $(3, 0)$

5) Find the axis of symmetry and then find the vertex. (AOS)

$$x = \frac{-2 + 3}{2}$$

$$x = \frac{1}{2} \text{ or } 0.5$$



find  
Sketch the graph of  $y = x^2 - 6x + 8$  by plotting the x- and y-intercepts and the vertex.

$$y = x^2 - 6x + 8$$

y-intercept: 8

zeros:

(2, 0) and (4, 0)

$$y = x^2 - 6x + 8 = (x-2)(x-4)$$

$\swarrow$                        $\searrow$   
 +2                      +4

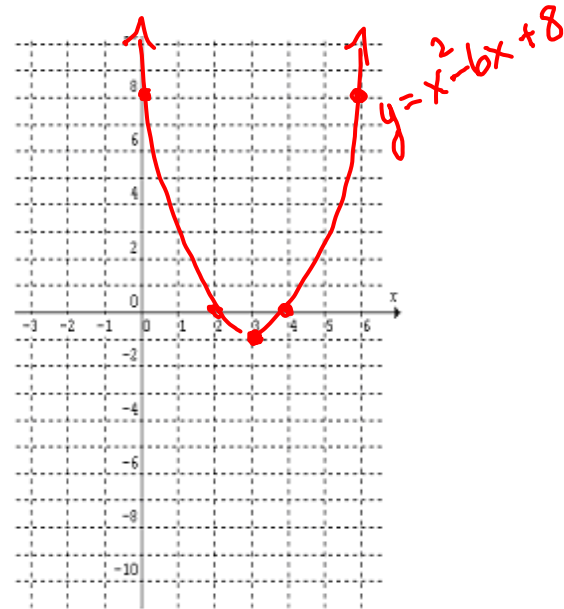
$$\begin{array}{r} 1 \times 8 \\ 2 \times 4 \end{array}$$

Vertex: AOS =  $\frac{2+4}{2}$

(3, -1)

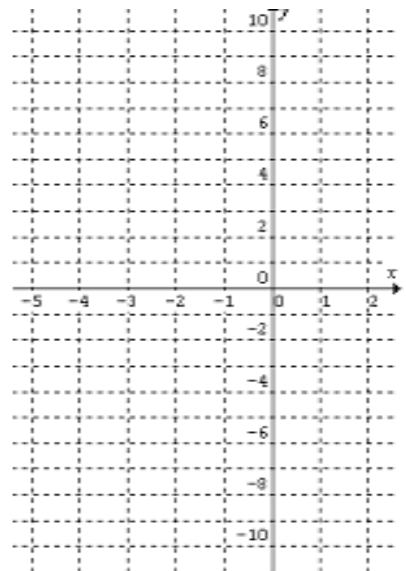
$$x = 3$$

Sketch the graph of  $y = x^2 - 6x + 8$  by plotting the x- and y-intercepts and the vertex.



Sub  $x=3$  into equation

$$\begin{aligned} y &= x^2 - 6x + 8 \\ &= (3)^2 - 6(3) + 8 \\ &= 9 - 18 + 8 \\ &= -1 \end{aligned}$$



<i>Question 1</i>			<i>Question 2</i>		
What are the zeroes of $y = (x - 4)(x + 8)$ ?			What are the zeroes of $y = -2(x - 5)(x + 17)$ ?		
<i>Question 3</i>			<i>Question 4</i>		
What is the axis of symmetry of $y = (x - 5)(x + 13)$ ?			What is the y-intercept of $y = (x - 5)(x + 1)$ ?		

	Original Equation	Change to Standard Form (show your work)	Same parabola? (yes/no)
A	$y = 2(x - 3)(x + 4)$		
B	$y = -3(x + 1)(x + 2)$		
C	$y = -(x - 6)^2 + 12$		